

HARD DISKS

INTRODUCTION

Pundits predict that solid-state flash memory disks will replace traditional internal hard disks inside our computers, as they are faster, more reliable and less power hungry. This is unlikely to happen any time soon, though, as a 16GB solid state disk can cost as much as £280.

Hard disks are still the fastest and cheapest way of storing large quantities of data. It's remarkably easy to run out of space on what once seemed to be a massive hard disk, whether you're an avid photographer, a keen home movie editor or you just like playing games.

Luckily internal hard disks are now cheaper than ever, and can store as much as 1TB, or around 1,000GB, of data. The vast number of models can be baffling, so we've gathered together 18 disks and put them through a set of demanding tests to see which are the best buys.

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GOLD STORAGE

The good old-fashioned hard disk is still the most cost-effective means of storing large quantities of data on your PC. We take 18 for a spin

Choosing a... Hard Disk

Choosing an internal hard disk for your PC can be confusing thanks to the endless number of models and their jargon-filled lists of specifications. Our buying guide will highlight the issues you should consider before purchasing a disk.

WHEN SATA'S DAY COMES

Internal hard disks connect to your PC using either Serial ATA (SATA) or the older Parallel ATA (PATA) interface. If you have an older PC with no free SATA ports, go for a PATA disk. If you have only SATA connectors, choose a SATA disk.

If your motherboard has both SATA and PATA ports available, you could choose either. SATA disks are easier to install, as their cables are thinner and easier to manage than the thick ribbon cables on PATA disks.

Bear in mind that manufacturers are phasing out PATA in favour of SATA, and large-capacity disks, such as the 1TB models here, will be available only in SATA versions. Some newer motherboards also lack PATA ports or can no longer boot Windows from a PATA disk.

The most recent version of PATA has a maximum speed of 133MB/s, whereas the latest version of SATA has a top speed of 300MB/s. These are theoretical speeds which you're unlikely to achieve in practice, but

the best SATA disks still tend to be quicker than their PATA counterparts.

If you want to use SATA disks but your motherboard supports only PATA, you can add SATA ports to your PC by buying a PCI adaptor card for as little as £25.

SPEED DATA

Once you've decided between a PATA or SATA model, you must ensure that your computer is compatible with your new disk. The original SATA I standard supported speeds of up to 150MB/s. The updated SATA II standard supports speeds up to 300MB/s. All the SATA disks in our round-up support SATA II and will work at this faster speed if possible.

Check the documentation that came with your computer or motherboard to see which version of SATA it supports. If your motherboard supports only SATA I, SATA II disks will still work, but at only 150MB/s. SATA II disks may require you to set a jumper pin on the back of the disk, telling it to operate at the slower speed. You should do this before installing the disk, and you should check the documentation for your computer or motherboard to see which version of SATA it supports.

PATA disks have a different compatibility issue. Some older PCs have trouble recognising PATA disks





How we test Hard disks

Our tests are designed to simulate real-life tasks for a realistic assessment of how each disk performs. To test read and write speeds, we use a script to time file transfers. Files are copied from a RAM disk to the hard disk and back. RAM disks use system memory and are far faster than any hard disk, so using it as the source ensures that any speed limitations are caused by the disk on test and not the source of the copy.

In our large files test, a 100MB file is copied to and from each hard disk 100 times. This shows how well a disk can cope with large files such as recorded TV shows. Our small files test repeats the task but with a selection of smaller files totalling 100MB. This simulates a PC backup.

We also test the time taken to access data using a free utility called HD Tach. The results are in the tables on page 100 and 101.

larger than 137GB. If you're using Windows 2000 or later, installing the latest Service Pack and updates should solve this. Otherwise, you may need to update your motherboard's BIOS. For more details about this problem, see www.seagate.com/support/kb/disc/tp/137gb.pdf.

POWER UP

It's easy to forget that your PC's power supply must have the appropriate connector to power your disk. PATA disks use a standard four-pin Molex power cable. SATA disks use the newer SATA power connector, which is thinner than a Molex plug and is easier to unplug. If your power supply doesn't have any SATA power connectors, you can buy a Molex-to-SATA converter for £4 (part code A12AZ) from www.maplin.co.uk.

THE PRICE IS RIGHT

The less a hard disk costs per gigabyte, the more you get for your money. In this month's Labs, we found that 500GB and 750GB disks have the lowest costs per gigabyte. Smaller- and larger-capacity models don't tend to be as good value.

If you need more than 750GB of storage but don't want to buy larger but less cost-effective disks, you could join two or more disks together as a RAID array (see *Upgrade Workshop*, *Shopper* 225). If your PC doesn't support RAID, you can buy a PCI RAID controller card for £30.

If you're just after more storage, the best bet is to buy the largest hard disk you can afford. If you're doing certain jobs, such as video editing, performance is crucial – our graphs on page 102 tell you which disks are the quickest.

This month

PATA HARD DISKS

EXCELSTOR

Jupiter J8160

Page 100



HITACHI Deskstar 7K160

HDS721616PLAT80

Page 100



MAXTOR

DiamondMax 21 160GB

Page 100



WESTERN DIGITAL

Caviar SE 400GB

Page 100



WESTERN DIGITAL

Caviar SE16 500GB

Page 101



SEAGATE Barracuda

Ultra ATA/100 500-GB

Page 101



SATA HARD DISKS

WESTERN DIGITAL

Caviar SE16 320GB

Page 101



HITACHI Deskstar P7K500

HDP725050GLA360

Page 101



SEAGATE Barracuda

7200.11 500GB

Page 101



WESTERN DIGITAL

WD AV 500GB

Page 100



HITACHI Deskstar 7K1000

HDS721075KLA330

Page 100



WESTERN DIGITAL

Caviar SE16 750GB

Page 100



SAMSUNG

Spinpoint F1 HD753LJ

Page 100



SEAGATE Barracuda

7200.11 750GB

Page 101



WESTERN DIGITAL

Caviar GP 1TB

Page 101



SEAGATE

Barracuda 7200.11 1TB

Page 101



HITACHI Ultrastar A7K1000

HUA721010KLA330

Page 101



SAMSUNG

Spinpoint F1 HD103UJ

Page 101



HARD DISKS

PATA HARD DISKS

MANUFACTURER	EXCELSTOR	HITACHI	MAXTOR	WESTERN DIGITAL
Model	Jupiter J8160	Deskstar 7K160 HDS721616PLAT80	DiamondMax 21 160GB	Caviar SE 400GB
Rating	★★★	★★★	★★	★★★
STORAGE				
Capacity	160GB	160GB	160GB	400GB
Formatted capacity (NTFS)	149GB	149GB	149GB	372GB
Price per gigabyte	£0.20	£0.20	£0.22	£0.15
Interface	UltraDMA 133	UltraDMA 133	UltraDMA 100	UltraDMA 100
Power connector	Molex	Molex	Molex	Molex
Spindle speed	7,200rpm	7,200rpm	7,200rpm	7,200rpm
Cache	8MB	8MB	8MB	8MB
Quoted seek time	8.5ms	8.5ms	11.0ms	10.9ms
HD Tach access time	13.1ms	13.4ms	14.5ms	13.0ms
Platters	1	1	1	3
Heads	2	2	2	5
Bearing technology	Fluid dynamic	Fluid dynamic	Fluid dynamic	Fluid dynamic
Noise level when idle	31dB(A)	28dB(A)	29dB(A)	29dB(A)
BUYING INFORMATION				
Price including VAT	£30 inc VAT	£30 inc VAT	£35 inc VAT	£56 inc VAT
Warranty	Three years	Three years	Three years	Three years
Supplier	www.pcnextday.co.uk	www.lambda-tek.com/componentshop	www.pcnextday.co.uk	www.yoyotech.co.uk
Details	www.excelstor.com	www.hitachigst.com	www.seagate.com	www.westerndigital.com
Part code	J8160	HDS721616PLAT80	STM3160215A	WD4000AAJB
REVIEW				

Excelstor's Jupiter J8160 costs the same as Hitachi's 160GB PATA hard disks. It performed consistently well in all our file transfer tests, especially when writing small files where it was the fastest PATA disk here. If you're looking for a cheap disk for a budget computer it is great value, but its relatively high cost per gigabyte makes the higher-capacity disks better value.

Hitachi's 160GB PATA disk costs the same as Excelstor's Jupiter and has similar performance. It wasn't as fast as the Jupiter when writing small files but edged ahead for reading large files, where it was the fastest PATA disk in our group. Both disks are good choices if you want a budget disk, but the higher-capacity models are better value per gigabyte.

Maxtor's 160GB PATA disk costs £5 more than the other drives with the same capacity. Unfortunately it was the slowest PATA disk in all our file transfer tests. Although it wasn't far behind the faster disks when reading both large and small files, it was noticeably slow when writing them. With better performers available for less, there's little reason to choose this hard disk.

Western Digital's 400GB disk costs only £26 more than the 160GB models here, so it's good value if you want a lot more storage. Unfortunately, it was the second-slowest PATA disk in most of our tests, although it fared better at writing small files, where it came third. If you need fast performance and a lot of storage, the 500GB disks here are all better value.



SATA HARD DISKS



MANUFACTURER	WESTERN DIGITAL	HITACHI	WESTERN DIGITAL	SAMSUNG
Model	WD AV 500GB	Deskstar 7K1000 HDS721075KLA330	Caviar SE16 750GB	Spinpoint F1 HD753LJ
Rating	★★	★★★★★	★★★★★	★★★★★
STORAGE				
Capacity	500GB	750GB	750GB	750GB
Formatted capacity (NTFS)	465GB	698GB	698GB	698GB
Price per gigabyte	£0.19	£0.15	£0.15	£0.17
Interface	SATA 300	SATA 300	SATA 300	SATA 300
Power connector	SATA	SATA, Molex	SATA	SATA
Spindle speed	7,200rpm	7,200rpm	7,200rpm	7,200rpm
Cache	8MB	32MB	16MB	32MB
Quoted seek time	10.9ms	8.5ms	10.9ms	8.9ms
HD Tach access time	13.4ms	12.6ms	12.7ms	14.4ms
Platters	3	4	4	3
Heads	6	8	8	6
Bearing technology	Fluid dynamic	Fluid dynamic	Fluid dynamic	Fluid dynamic
Noise level when idle	29dB(A)	32dB(A)	33dB(A)	29dB(A)
BUYING INFORMATION				
Price including VAT	£84 inc VAT	£102 inc VAT	£108 inc VAT	£116 inc VAT
Warranty	Three years	Three years	Three years	Three years
Supplier	www.morecomputers.co.uk	www.yoyotech.co.uk	www.shop.bt.com	www.quietpc.com
Details	www.westerndigital.com	www.hitachigst.com	www.westerndigital.com	www.samsung.com
Part code	WD5000AVJS	HDS721075KLA330	WD7500AAKS	HD753LJ
REVIEW				

The WD AV is the most expensive 500GB SATA disk here, and costs 19p per gigabyte. Unfortunately, the higher price doesn't mean better performance and it was the second-slowest SATA disk in our large files tests. It fared better in our small files tests, but it couldn't keep up with Hitachi's 500GB Deskstar, which is £14 cheaper. There's little reason to buy the WD AV at this price.

Hitachi's 750GB Deskstar has a very low cost per gigabyte of just 15p. Overall, it was one of the fastest SATA disks in our small files tests. It was also noticeably quick at writing large files but fell slightly behind the front-runners when reading them, although 79.68MB/s is still quick. With great performance and a low price, the 750GB Deskstar is our Best Buy SATA disk.

Western Digital's 750GB disk performed consistently well, especially in our large files test where it was the third-fastest disk overall. It was also quick at reading and writing small files, but couldn't quite keep up with Hitachi's 750GB Deskstar. It's good value at just 15p per gigabyte, but the Deskstar is even cheaper and has better performance.

Samsung's 750GB Spinpoint was second only to Samsung's 1TB disk when writing large files and reading small files. It couldn't repeat this impressive performance when reading large files or writing small files, though, and came middle, with Western Digital's 750GB Caviar edging ahead. The Hitachi and Western Digital 750GB disks are cheaper and more consistent, making them better value.



BEST BUY		SATA HARD DISKS		
WESTERN DIGITAL	SEAGATE	WESTERN DIGITAL	HITACHI	SEAGATE
Caviar SE16 500GB	Barracuda 7200.10 Ultra ATA/100 500-GB Hard Drive	Caviar SE16 320GB	Deskstar P7K500 HDP725050GLA360	Barracuda 7200.11 500GB
★★★★★	★★★★★	★★	★★★★	★★★
500GB	500GB	320GB	500GB	500GB
465GB	465GB	298GB	465GB	465GB
£0.14	£0.16	£0.17	£0.15	£0.15
UltraDMA 100	UltraDMA 100	SATA 300	SATA 300	SATA 300
Molex	Molex	SATA	SATA	SATA
7,200rpm	7,200rpm	7,200rpm	7,200rpm	7,200rpm
16MB	16MB	16MB	16MB	32MB
10.9ms	8.9ms	8.9ms	8.3ms	9.5ms
13.2ms	14.6ms	12.7ms	18.6ms	12.1ms
3	3	2	2	2
6	6	4	4	4
Fluid dynamic	Fluid dynamic	Fluid dynamic	Fluid dynamic	Fluid dynamic
29dB(A)	37dB(A)	29dB(A)	26dB(A)	28dB(A)
£66 inc VAT	£75 inc VAT	£57 inc VAT	£70 inc VAT	£72 inc VAT
Three years	Five years	Three years	Three years	Five years
www.pcnextday.co.uk	www.scan.co.uk	www.rlsupplies.co.uk	www.lambda-tek.com/components	www.lambda-tek.com/components
www.westerndigital.com	www.seagate.com	www.westerndigital.com	www.hitachigst.com	www.seagate.com
WD5000AAKB	ST3500630A	WD3200AAKS	HDP725050GLA360	ST3500320AS
Western Digital's 500GB PATA disk did well in our large file tests, where it was only marginally slower than Seagate's Barracuda. Its performance in our small files tests was respectable and it was quicker at writing small files than the Barracuda. The Caviar is £9 cheaper than Seagate's disk and is a more consistent performer, making it the better buy.		Western Digital's 320GB Caviar is the cheapest SATA disk in our group at only £52 including VAT. Unfortunately, it was consistently slow in all our file transfer tests. It was the slowest SATA disk in our large files tests, and the only disk not to exceed 7MB/s when writing small files. It may be cheap, but its poor performance means we can't recommend it.		Hitachi's 500GB Deskstar sped through our small files tests, particularly in our write test. Its large file performance was just as good and its read speed of just under 82MB/s wasn't far behind the front-runners. Its speed of 66.39MB/s when writing large files was among the slowest here, though. The Deskstar has a low cost per gigabyte of 15p, but Hitachi's 750GB Deskstar is a better buy.
				

MOST WANTED				
SEAGATE	WESTERN DIGITAL	SEAGATE	HITACHI	SAMSUNG
Barracuda 7200.11 750GB	Caviar GP 1TB	Barracuda 7200.11 1TB	Ultrastar A7K1000 HUA721010KLA330	Spinpoint F1 HD103UJ
★★★	★★★	★★★	★★★★	★★★★
750GB	1TB	1TB	1TB	1TB
698GB	930GB	930GB	930GB	931GB
£0.17	£0.18	£0.20	£0.23	£0.23
SATA 300	SATA 300	SATA 300	SATA 300	SATA 300
SATA	SATA	SATA	SATA, Molex	SATA
7,200rpm	7,200rpm	7,200rpm	7,200rpm	7,200rpm
32MB	16MB	32MB	32MB	32MB
9.5ms	8.9ms	12.0ms	8.2ms	8.9ms
12.4ms	12.9ms	13.4ms	12.4ms	14.0ms
3	4	4	5	3
6	8	8	10	6
Fluid dynamic	Fluid dynamic	Fluid dynamic	Fluid dynamic	Fluid dynamic
29dB(A)	29dB(A)	29dB(A)	29dB(A)	29dB(A)
£116 inc VAT	£170 inc VAT	£187 inc VAT	£211 inc VAT	£216 inc VAT
Five years	Three years	Five years	Five years	Three years
www.lambda-tek.com/components	www.shop.bt.com	www.morecomputers.co.uk	www.lambda-tek.com/components	www.quietpc.com
www.seagate.com	www.westerndigital.com	www.seagate.com	www.hitachigst.com	www.samsung.com
ST3750330AS	WD10EACS	ST31000340AS	HUA721010KLA330	HD103UJ
Seagate's 750GB Barracuda has an attractive five-year warranty and was very fast at writing and reading large files. Unfortunately, it was particularly slow at reading small files, although it did better at writing them, coming mid-table at just over 8MB/s. This wouldn't be so bad if it were cheap, but Hitachi's better-performing Deskstar 750GB hard disk is £14 cheaper.		The Caviar GP is claimed to use 4-5W less power than most hard disks. Unlike the other disks, testing with a meter meant that this disk didn't get enough power to run, which implies the claim is true. It fared well in our large files test. Its speed when reading small files was also fine but it was slow at writing small files. The Caviar GP isn't that quick, but it's cheap for a 1TB disk at just 17p per gigabyte.		We were astonished at the performance of Samsung's 1TB disk in our large files test, where it was the first disk we've seen to exceed 100MB/s. It was also very quick when reading small files, but was outperformed by all three of Hitachi's SATA disks when writing them. It is expensive at 23p per gigabyte, but this is the disk to get if you need the fastest possible performance.
				

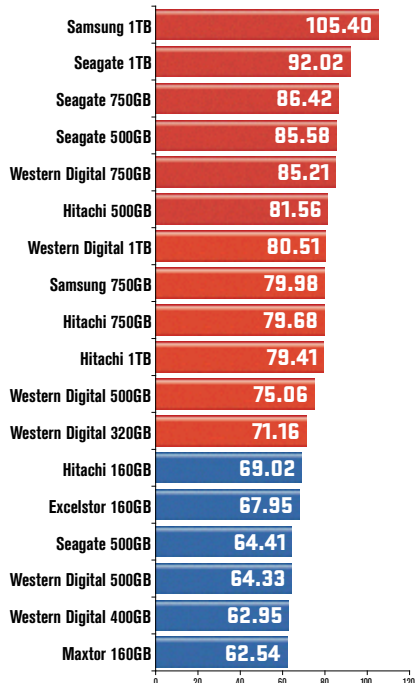
BENCHMARKS

PATA HARD DISKS

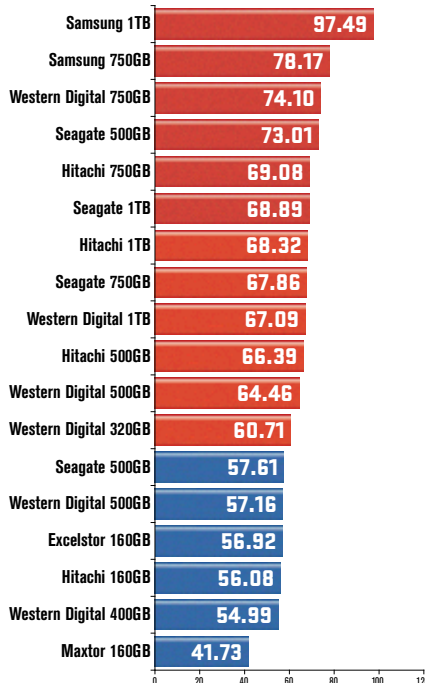
SATA HARD DISKS

Performance

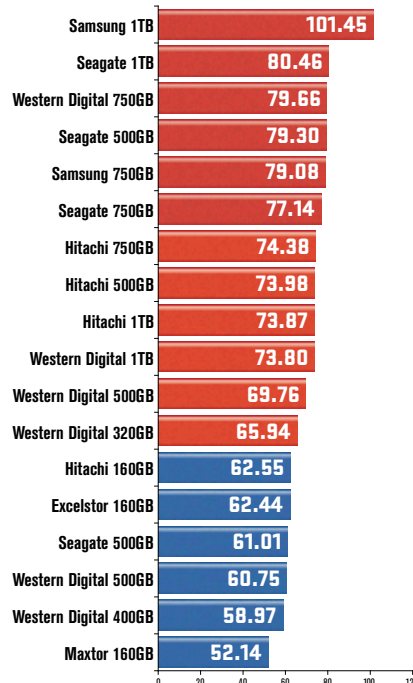
Reading Large Files (MB/s)



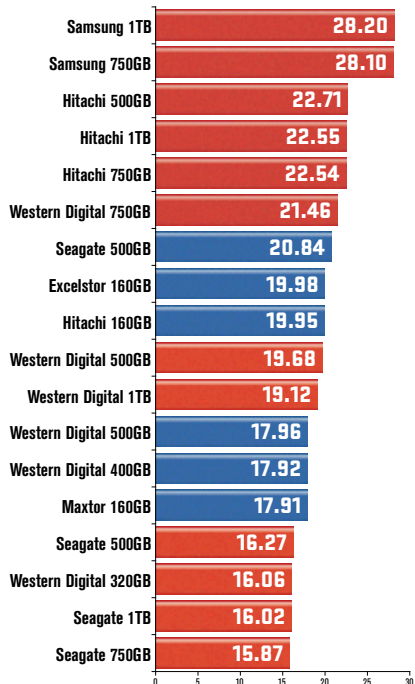
Writing Large Files (MB/s)



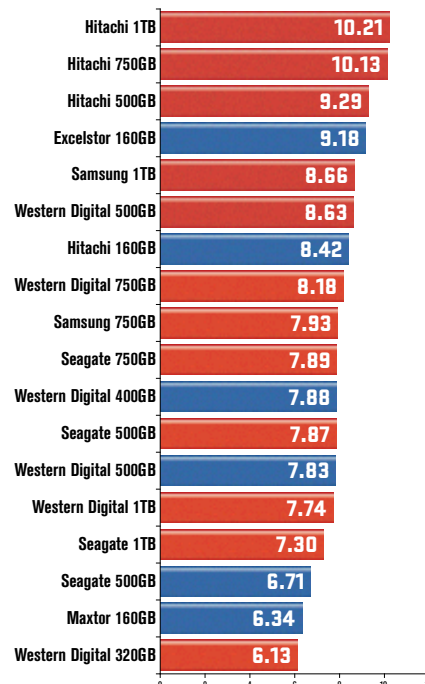
Large Files Overall (MB/s)



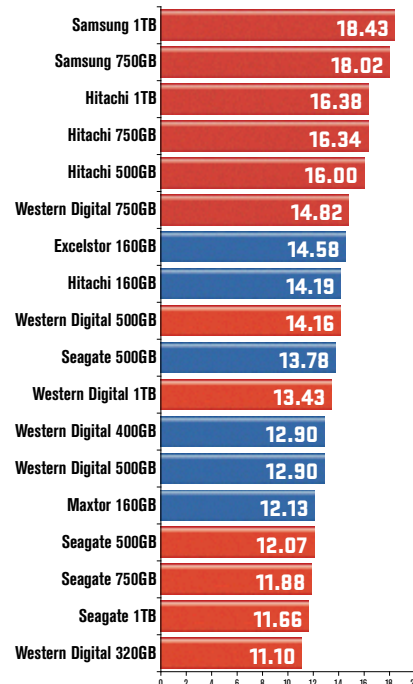
Reading Small Files (MB/s)



Writing Small Files (MB/s)



Small Files Overall (MB/s)



Labs verdict Hard disks

Competition was fierce in this month's hard disk Labs, which made it particularly difficult to find a winner. However, Western Digital's 500GB Caviar SE16 emerged as the best PATA hard disk here. It performed consistently well in all our tests but costs only 14p per gigabyte, so it wins our Best Buy award.

Samsung's Spinpoint F1 HD103UJ impressed us not only with its huge 1TB capacity but also

its breakneck performance. It's expensive at 23p per gigabyte but it's otherwise a great hard disk, so it wins our Most Wanted award.

It's the 750GB hard disks that strike the best balance between price and capacity, though. Hitachi's Deskstar 7K1000 was not only the cheapest SATA disk at 15p per gigabyte, but it had great performance, too. It's great value and wins our Best Buy award. **CS**

PATA HARD DISKS

WESTERN DIGITAL Caviar SE16 500GB

★★★★★



SATA HARD DISKS

HITACHI Deskstar 7K1000 HDS721075KLA330

★★★★★



SAMSUNG Spinpoint F1 HD103UJ

★★★★★

